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ANTIGENIC AND IMMUNOLOGICAL INTERRELATIONS BETWEEN BRUCELLA AND
TULAREMIA CAUSATIVE AGENTS

(Following is the translation of an article by Yu. Parnas, Institute of Microbiology and Epidemiology of the Medical Academy in Lublin (Poland), published in the Russian-language periodical ZhMEI (Journal of Microbiology, Epidemiology, and Immunobiology), No 5, 1967, pages 60-62. It was submitted on 7 Jul 1966.)

This work is dedicated to the memory of the distinguished tularemia specialist Prof. B. Ya. Elbert.

In this report new observations are generalized relative to the serological bonds between the brucella and tularemia microbes.

The following strains were studied: *Br. melitensis* No 16M, abortus No 12 and suis No 1330, *Fr. tularensis* avirulent strain Elbert (USSR), and also several other strains.

As was established by the method of precipitation of acetone-extracted antigen substances in gel (parnas, 1961), the three typical strains of brucella regularly caused the formation of 6 lines of precipitation, and atypical strains - 3 and 4 lines. For tularemia antigens with homologous serum 4 lines of precipitation were obtained (Table 1). It was not possible to establish a bond between the antigens of brucella and the tularemia causative agent.

Together with this, during the study of the amino acid composition of representatives of these groups of microorganisms only minimal differences were revealed between them. These were expressed in the fact that in the tularemia causative agent we additionally detected α -aminobutyric and 2-aminopimelic acids.

Considerably more significant differences were detected in the composition of bacterial polysaccharides (Table 2). It turned out that based on composition of saccharides and biochemical type all three representatives of brucella were the same, but differed from the tularemia causative agent in which ribose and xylose were exposed. At the same time, based on composition of saccharides the tularemia bacteria were close to *Pasteurella rodentium*, while serologically these microorganisms were different. *Past. multocida* and *Fr. tularensis*, though related serologically, differed biochemically.

For the purpose of investigating possible bonds between the brucellosis phages 212/XV and 371/XXIX on antigen substances of

bacteria which are obtained by acetone-extraction (Parnas, 1965). Phages were taken in a titer of $5 \cdot 10^9$ particles in 1 ml. It was established that brucellosis phages were not adsorbed on antigens obtained from *Staphylococcus pyogenes*, *Klebsiella pneumoniae*, *scleromatis*, *ozenae*, *Listeria monocytogenes*, *Erysipelothrix insidiosa*, *Mycobacterium smegmatis*, and *Past. multocida*. On antigens obtained from all three types of brucellosis, and also the tularemia causative agents, adsorption of brucellosis phages was noted. However, the lytic activity of these phages was revealed only in respect to brucellosis, the tularemia cultures were not lysed by these phages.

Table I

Precipitation in gel with brucellosis and tularemia antigens

Антисыворотка	Число линий преципитации с антигеном					
	бруцеллезный					туляремия
	melitensis № 16 А	suis № 1330	abortus № 544	melitensis атипичный	suis атипичный	
Br. melitensis . .	6	6	6	4	3	0
Br. suis	6	6	6	4	3	0
Br. abortus	6	6	6	4	3	0
Br. melitensis атипичный	4	4	4	4	3	0
Br. suis атипичный	3	3	3	3	0	0
Fr. tularensis . . .	0	0	0	0	0	4

Key: (a) Antiserum; (b) Number of lines of precipitation with acetone; (c) brucellosis; (d) melitensis atypical; (e) suis atypical; (f) tularemia.

Consequently a certain similarity was revealed between antigens of brucella and the tularemia causative agents.

Table 2

Saccharides detected in bacteria of the family Parvobacteriaceae and biochemical types of these bacteria

Полисахарид	Brucella (I тип)			Fr. tularensis (тип II)	Pasteurella	
	melitensis	abortus	suis		multocida (тип III)	rodentium (тип I)
Уроновая кислота	+	+	+	+	+	+
Глюкоза	+++	+++	+++	+++	+++	+++
Галактоза	+++	+++	+	+++	+	+++
Глюкозамин	+++	+	+++	+++	+	+++
Манноза	+++	++	+++	+++	+	+++
Ксилloза	-	-	-	+	-	+
Рибоза . . .	-	-	-	+	-	+

Key: (a) Polysaccharide; (b) Brucella (type I); (c) type II; (d) multocida (type III); (e) rodentium (type I?); (f) Uronic acid; (g) Glucose; (h) Galactose; (i) Glucosamine; (j) Mannose; (k) Xylose; (l) Ribose.

These positions confirmed the experiments on laboratory animals and observations on man. A determination was made of the opsono-phagocytic index using the 2 antigens - brucellosis and tularemia (Pharnas, 1958). 18 rabbits and 20 guinea pigs were infected with brucella. In each animal a determination was made of the opsono-phagocytic index in respect to brucella, tularemia causative agent, and Pasteurella (Table 3). At the same time that the common opsono-phagocytic index for the 18 rabbits in respect to brucella comprised 473.23 (100%), in respect to Fr. tularensis it equalled 203.07 (42.9%). Consequently, in animals infected with brucella opsonization of brucella took place; also of Fr. tularensis, though to a lesser degree. Analogous results were obtained on guinea pigs.

According to the opinion of some authors the brucellosis and tularemia allergens are specific. On 20 rabbits infected with the cutaneous-allergic reactions with brucellin and tularin. Specific differences were noted between these two allergens.

Cutaneous-allergic reactions with these allergens were also studies on man. Out of 51 men, reacting positively to brucellin, 36 also reacted to tularin, which testified to the presence of allergic parareactions in man.

Table 3

Opsono-phagocytic indices in rabbits and guinea pigs infected with brucellosis

Показатель	Кролики	Морские свинки
Число животных	18	20
Общий опsono-фагоцитарный индекс		
с Brucella	473,23 (100%)	422,74 (100%)
с Fr. tularensis	203,07 (42,9%)	169,92 (38,3%)
с Past. multocida	Не определяли	77,11 (17,4%)
Средние значения опsono-фагоцитарного индекса $\pm m$		
с Brucella	26,29 \pm 5,69	22,14 \pm 6,58
с Fr. tularensis	11,28 \pm 1,57	8,5 \pm 4,31
с Past. multocida	Не определяли	3,86 \pm 2,58

Key: (a) Index; (b) Rabbits; (c) Guinea pigs; (d) Number of animals; (e) Common opsono-phagocytic index with; (f) Average values of opsono-phagocytic index $\pm m$ with; (g) Not determined.

Conclusions

Brucella and the causative agents of tularemia displayed both similar features (amino acid composition, capacity to adsorb brucellosis phage, agglutination and complement-fixing activity, stimulation of opsonins, cross allergenicity) as well as differences (cultural and fermentative, electron microscope study of cell morphology, composition of saccharides, results of precipitation in gel).

Literature

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